

COMMERCIAL SPACE TRANSPORTATION

Since 1989, the Department of Transportation/Federal Aviation Administration has licensed over 220 U.S. commercial space launches. The FAA has also granted over 30 experimental permit launches since 2006. Activity in the U.S. commercial sector is expected to increase for both orbital and suborbital launches.

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activity including launch vehicles and non-federal launch sites authorized by Executive Order 12465 and Title 51 U.S. Code, Subtitle V, Chapter 509 (formerly the Commercial Space Launch Act). Title 51 and the Executive Order also direct the Department of Transportation to encourage, facilitate, and promote U.S. commercial launches. AST's mission is to license and regulate commercial launch and reentry operations and non-federal launch sites to protect public health and safety, the safety of property, and the national security and foreign policy interests of the United States.

Overview

The FAA licenses several expendable vehicles used for commercial orbital launches. The most frequently used orbital vehicles are:

- Falcon 9, an intermediate-class launch vehicle built, operated, and marketed by Space Exploration Technologies Corp. (SpaceX);
- Antares, Pegasus, Taurus and Minotaur vehicles built, operated, and marketed by Orbital Sciences Corporation (Orbital);
- Zenit-3SL, a heavy-class vehicle built by the Ukrainian company KB Yuzhnoye for the Russian-owned Sea Launch venture, launched from a floating launch platform based at Long Beach, CA; and
- Atlas V, a heavy-class vehicle built by United Launch Alliance (ULA), a joint venture between Boeing and Lockheed Martin, and marketed by Lockheed Martin Commercial Launch Services (LMCLS).

Companies such as Armadillo Aerospace have also carried out suborbital licensed launches. In addition to launch licenses, experimental permits were first granted by the FAA in 2006. Permits are used for suborbital reusable vehicle development and test flights. Companies that have been active in permit launches include Blue Origin, Masten Space Systems, SpaceX, and Scaled Composites.

The FAA Office of Commercial Space Transportation does not license or grant permits for amateur-class rockets which are unmanned rockets that have less than 200,000 pound-seconds of total impulse and cannot reach an altitude greater than 150 kilometers above the Earth's surface.

The FAA licenses launches or reentries carried out by U.S. persons inside or outside the United States. The FAA does not license launches or reentries the U.S. Government carries out for the Government (such as those operated for and by NASA or the Department of Defense).

Eight commercial spaceports are currently licensed by the FAA. These are located in six states: Alaska, California (part of Vandenberg Air Force Base and Mojave Air and Space Port), Florida (Cape Canaveral and Cecil Field Spaceport), New Mexico, Oklahoma, and Virginia. Several other commercial spaceports around the United States are under development including locations in Hawaii, Colorado, and Texas.

Review of 2013

There were seven orbital FAA-licensed launches in 2013, an increase from five in 2012. SpaceX's Falcon 9 vehicle made three launches including their first mission to geosynchronous orbit. There are nearly 50 future launches on the SpaceX manifest. Orbital Sciences completed the first two launches of the new Antares vehicle and also launched one Minotaur 1 vehicle. Sea Launch (a multinational consortium) had one launch of the Zenit 3SL launch vehicle that resulted in a launch failure. SpaceX also carried out the only licensed reentry mission when the Dragon capsule returned from orbit for an ocean landing after docking at the International Space Station.

In addition, there were 7 permit suborbital flights during 2013. Five were carried out by SpaceX in Texas with their Grasshopper vehicle to test vertical landings of a reusable first stage for the Falcon orbital launch vehicle. Two permit suborbital flights were done by Scaled Composites with SpaceShipTwo including the first powered rocket engine flight. Other companies are preparing for permit flights in 2014.

Successful permit flights or increases in private financing in 2014 could lead some suborbital companies to pursue licensed flights and increase the 2014 forecast.

	2012	2013	2014 Forecast
Licensed Launches	5	7	8-14
Permitted Launches	2	7	8-25

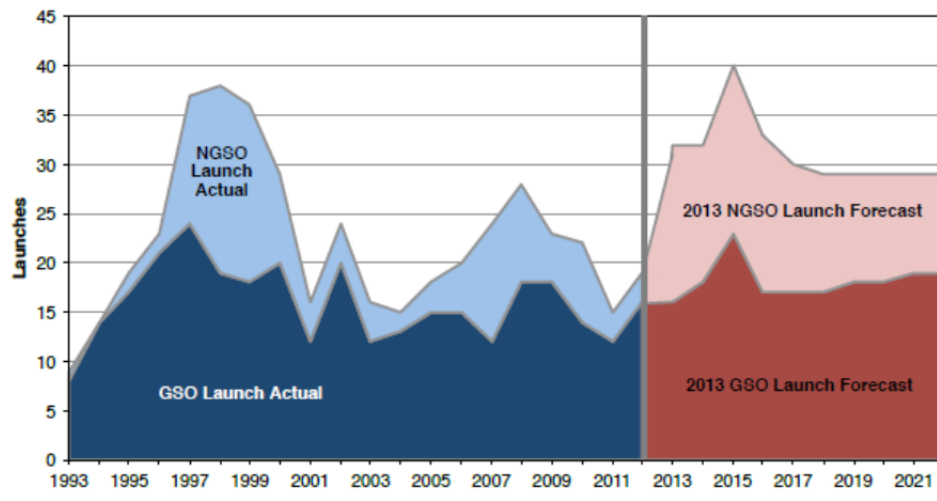
FAA Licensed and Permitted Launches

Worldwide there were 23 orbital commercial launches in 2013, compared to 20 in 2012. Russia led competitors with 12 orbital commercial launches in 2013, followed by six by the U.S. (U.S.-manufactured vehicles), four by Europe and one by Sea Launch. Overall there were 81 civil, commercial and military worldwide launches in 2013 compared to 78 in 2012.

For more details, see the annual Compendium and *Year in Review* reports available online at: http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/#accst

Global Orbital Launch Forecast

In May 2013, the FAA and the Commercial Space Transportation Advisory Committee (COMSTAC) published their annual global forecast for commercial launch demand, the *2013 Commercial Space Transportation Forecasts*. The report calculates satellite demand and then applies models to estimate international commercial launch demand. Multiple satellites can fly on one launch vehicle. The 2013 forecast estimated an average global demand of about 18 commercial launches per year to geosynchronous orbit (GSO) and a global demand of about 13 launches per year to non-geosynchronous orbits (NGSO). The forecast covers the years 2013-2022. The 2013 forecast is up slightly from the 2012 forecast for both GSO and NGSO destinations.



Combined 2013 GSO and NGSO Historical Launches and Launch Forecasts

Commercial GSO launches are used for communications satellites with masses ranging from 2,500 to over 6,000 kilograms. Demand for commercial NGSO launches spans a number of markets and payload sizes, including resupply of the International Space Station, commercial remote sensing; science and technology demonstration; and replenishment and replacement of low Earth orbit communications satellite systems reaching the end of their lifespan. The forecast shows an increasing trend in demand for medium-to-heavy sized launch vehicles. Despite increased interest in building very small satellites (including satellites known as “cubesats”), the demand for small launch vehicles is only an average of 0.3 launches per year. Many small satellites find rides aboard medium-to-heavy lift launch vehicles as secondary payloads.

The GSO and NGSO forecasts are not a prediction of what will actually be launched but instead represents the expected demand for launch services, based on a variety of inputs. The complete forecast report is available at:

http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/forecasts/

Suborbital Reusable Vehicles Forecast

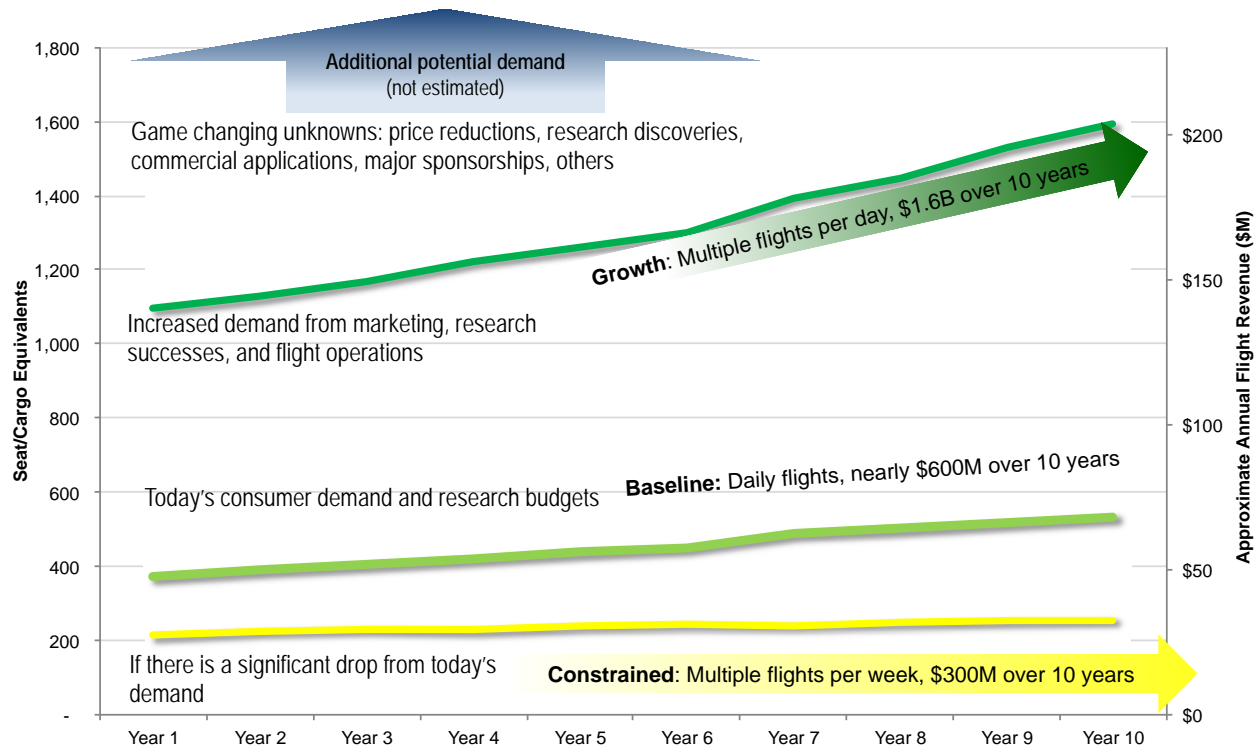
The most recent global forecast for suborbital reusable vehicles (SRVs) was completed in July 2012. A report prepared by the Tauri Group for the FAA and Space Florida covered a 10-year period that estimated demand once new suborbital vehicles begin flying. The goal of the study was to provide information for government and industry decision makers on the emerging SRV market by analyzing trends and areas of uncertainty in eight distinct markets SRVs could address. The eight markets include: Commercial Human Spaceflight, Basic and Applied Research, Aerospace Technology Test and Demonstration, Media and Public Relations, Education, Satellite Deployment, Remote Sensing, and Point-to-Point Transportation. The forecast includes three demand scenarios: baseline, growth, and constrained. Instead of flights, the forecast estimates seat demand. The demand is either for one seat for a single occupant or a cargo equivalent of 3.3 lockers (based on the size of mid-deck lockers used aboard the Space Shuttle).

Total projected demand for SRVs, across all eight markets, is estimate to begin at around 373 seat/cargo equivalents in Year 1 and increasing to 533 seat/cargo equivalents in the tenth year of the baseline case. Year 1 represents the first year of regular SRV operations. Demand under the growth scenario, which reflects increases due to factors such as marketing, research successes, and flight operations, grows from about 1,100 to more than 1,500 seat/cargo equivalents over ten years. The constrained scenario, which reflects significantly reduced consumer spending and government budgets, shows demand from about 213 to 255 seat/cargo equivalents per year.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Baseline Scenario	373	390	405	421	438	451	489	501	517	533	4,518
Growth Scenario	1,096	1,127	1,169	1,223	1,260	1,299	1,394	1,445	1,529	1,592	13,134
Constrained Scenario	213	226	232	229	239	243	241	247	252	255	2,378

Total projected demand for suborbital reusable vehicles by seat/cargo equivalents

Demand for SRVs is dominated by Commercial Human Spaceflight. The analysis indicates that about 8,000 high net worth individuals from across the globe are sufficiently interested and have spending patterns likely to result in the purchase of a suborbital flight. The second largest area of demand is Basic and Applied Research, funded primarily by government agencies, and also by research for not-for-profits, universities, and commercial firms. Aerospace Technology Test and Demonstration, Education, Satellite Deployment, and Media and PR generate the remaining demand. The Remote Sensing and Point-to-Point Transportation markets are not forecasted to drive launches at this time.



10-year Suborbital Reusable Vehicle demand forecast

For more details, see the *Suborbital Reusable Vehicles: A 10-Year Forecast of Market Demand* report available online at:

http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/forecasts/

Some companies have announced plans to begin operational suborbital flights carrying people in 2014.